THE BROODING HABITS AND EARLY DEVELOPMENT OF TRITHYREUS PENTAPELTIS (COOK), (ARACHNIDA: SCHIZOMIDA)[1]

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The Schizomida and Palpigradi are the only two of the several little known and seldom studied extant arachnid orders in which the complete life history is unknown. While neither of these orders lend themselves readily to laboratory study, I have had some success in keeping a few species of Schizomida alive under lab conditions.

Schizomids are small arachnids, typically 4-7mm., which spend their lives in generally moist conditions in leaf litter, under rocks and logs, and a few species occur in caves. The distribution of the 75 described species is circumequitorial, with two worldwide genera, one genus limited to Africa and one to Mexico. Their closest related order is Thelyphonida, represented in the southern United States by *Mastigoproctus giganteus* (Lucas), the common vinegaroon.

Post embryonic development of most schizomids probably consists of five instars and four molts over a period of two or three years. The nymphal instars resemble the adults but are smaller and lack, in varying degrees, the cuticular sclerotization of the adults. The first post embryonic instar is nearly completely white, excepting slight sclerotization of the opposing parts of the chelicerae. The sexual differences manifest in the flagellum of the males occur at the last molt, although penultimate males are sometimes recognizable. Ecdysis has never been observed even though I have kept several feeding subadults under observation for many months.

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The general breeding habits of schizomids were originally assumed to be similar to that of the closely related thelyphonids. Subsequently Hansen and Sorensen (1905) described a spermatophore attached to the venter of a female *Schizomus latipes* Hansen and Sorensen from Seychelles, confirming a similarity. Sturm (1958) published an account of his observations of the entire courtship and sperm transfer of the Columbian *Trithyreus sturmi* Kraus, and Kraus and Beck (1967) described the mating behavior of the Brazilian *T. braziliensis* Kraus and Beck. The development of the zygotes is undescribed even though gravid females are not uncommon in collections.

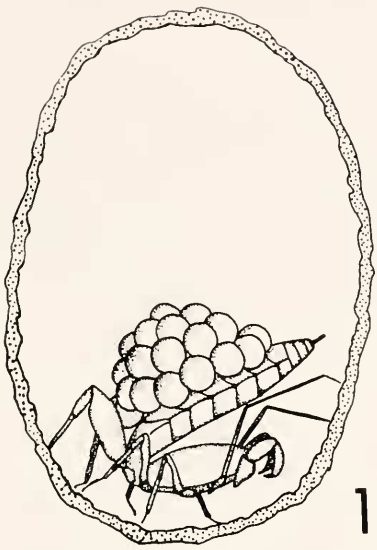
Oviposition has previously been documented only by Gravely (1915) in *S. peradeniyensis* Gravely of Ceylon. He reported that a female kept in a small terrarium constructed a chamber next to one of the glass walls. He was able to observe that a few eggs were oviposited and attached to the venter of the parent. For some reason the brooding was abortive as the female ate the eggs soon after depositing them.

On January 14, 1971 Dr. Bruce Firstman and I were lucky enough to capture a mating pair of *T. pentapeltis* (Cook) in Palm Canyon, Palm Springs, Riverside County, California. The following chronology and figures describe in detail the ensuing brooding events and development which were previously undescribed for these little known arachnids.

Day 0. Bruce Firstman and I captured a male and female *Trithyreus pentapeltis* (Cook) in leaf litter under rocks, in Palm Canyon, near Palm Springs, Riverside County, California. The pair were returned to my home and placed in a 5½ × 9cm glass chamber, with 5cm of loosely packed soil and 2cm of oak leaf litter on top. Several holes were made by pushing forceps into the soil next to the glass, so that observations could be made on subterranean habits. Both the male and the female investigated the holes and would spend several hours at a time motionless in the holes, however they periodically returned to the surface.

Day 55. The female was noticed particularly deep in a hole, apparently moving soil and other particles away from the radius of her body. This continued for five days, working irregularly, building a chamber about 3cm below the surface.

Day 60. The chamber completed, the female remained motion-



FIGURES 1 and 2. Fig. 1, female *Trithyreus pentapeltis* shown in chamber with eggs attached to venter. Fig. 2, well developed young ready to molt and drop off the female.

less at the bottom of the oval 12mm×9mm chamber. About 60% of the chamber wall was soil, the remainder being the glass, which provided an excellent view to the inside.

Day 71. In the preceding time the female's abdomen was noticed to become very much distended, the pleura being conspicuously white, supposedly from the presence of developing eggs.

Day 72. The female was found on the bottom of the chamber as usual, however a hemispherical mass of 30 eggs was attached to the venter of her abdomen, which was oriented over her back (Fig. 1). Since oviposition was completed when I discovered them I have no idea how long the entire egg laying process took, however it was less than 24 hours.

Day 102. Up to this time the female was quite active within the chamber, with no great changes noticed in the eggs. The only difference in the eggs was gradual change in shape from spherical to oval, which was noticed in the previous few days.

Day 107. An obvious development in shape of the eggs became

apparent as the gradual ovaling noticed in the previous week seemed to accelerate. The eggs were quite elongate with the long axis parallel to the female's body.

Day 108. The most significant change to this time occurred as the young sprouted appendages. Six pairs of appendages were recognizable; four pairs of legs, the pedipalps and the chelicerae were represented by two undifferentiated lobes. The telson was not visible. Their position on the female changed, as they positioned themselves on the venter, dorsum and sides of the abdomen in a complete circle around her (Fig. 2). All were arranged very orderly on her abdomen, the bodies oriented in the same direction as the mother. The young were stacked neatly upon one another with the appendages intertwined for a fast hold. It seemed that the young must have accomplished this movement from the original position of the eggs by themselves, but I did not notice them to move.

Day 145. The female continued to move about, but there was no indication of movement in the young. The only change was the slight development in color from white to a slight pink in the chelicerae and a general development of the limbs. It was possible to distinguish the chelicerae and the telson as well as more definition of abdominal segmentation.

Day 146. Two young molted and dropped off the mother's back onto the floor of the chamber. Their movement was infrequent and sluggish. Setae were noticeable on the legs, the telson, and especially so on the venter of the abdomen distally. The body was very white with only slight coloring in the chelicerae, a slight pinkish brown.

Day 147. About half of the young dropped off the mother and were on the floor of the chamber. Some young were more active than others, but motion was still quite sluggish.

Day 148. All of the young had made their separation, however the skins of the young, which were molted as they dropped off were still attached to the mother. The young were still sluggish, but they climbed to various heights on the chamber wall, indicating some activity.

Day 156. The mother had shed all the skins left by the young and the young were all much more active. They acquired some further darkening of the chelicerae, but no other color changes were obvious.

Day 157. The mother finished the rearing by breaking a hole in the chamber wall and exited to the surface. All but four of the young left the chamber and were to be seen in the leaf litter, on the surface and in the soil next to the glass.

Day 167. The female was found dead, with no signs of food in her. The male was still apparently doing well as were many of the young. Some food was available in the form of tiny collembola, but I did not see any of the young pursue or eat any, nor did I see any sign of cannibalism among the young. I never saw the adults eat, but the male became obviously fat soon after the emergence of the young. I am sure the collembola were much too small for an adult to catch and eat, so the evidence seems to indicate that the male ate some young.

The total number of instars for *T. pentapeltis* is six, one embryonic and five post embryonic, but it will remain unknown whether these figures are consistent throughout the order. Judging by the consistency of molts among the Pseudoscorpionida and other morphologically consistent groups it is my opinion that the number found in *T. pentapeltis* will be found to hold true for most or all of the species of *Trithyreus* and *Schizomus*.

Two vials in the collection of the American Museum of Natural History, New York contain embryonic schizomids. Both of these collections came from caves in Mexico collected by Dr. Robert W. Mitchell and Mr. James Reddell. The collectors indicated (pers. comm.) that the females were collected at large with eggs attached much the same as in Figure 1., however with fewer eggs. The fact that these cavernicolous species brood without use of the chambers may or may not be a modification due to cave existence.

The extreme difficulty of inducing schizomids to eat and mate in captivity is a hinderance to the further investigation of their habits. The paucity of information available on schizomid biology is due to their relative rarity and apparent unsuitability for laboratory observation. Until their specific requirements are better known we must rely on chance observations in the field and fortuitous events in the lab to further our knowledge of the biology of this group.

Literature cited

Gravely, F. H. 1915. Notes on the habits of Indian Insects, Myriapods, and Arachnids. Rec. Indian Mus., Calcutta. II: 483-539.

Hansen, H. J. and W. Sorensen. 1905. The Tartarides, a tribe of the order Pedipalpi. Arkiv. Zool. 8:1-78.

Kraus, O. and L. Beck. 1967. Taxonomie und Biologie von Trithyreus brasilliensis n. sp. (Arach.: Pedipalpi: Schizopeltidia). Senck. biol. 48(5/6):401-405.

Sturm, H. 1958. Indirekte Spermatophorenubertragung bei dem Geisselskorpion Trithyreus sturmi Kraus (Schizomidae, Pedipalpi). Naturwiss. 45:142-143.

2.0147 The brooding habits and early development of Trithyreus pentapeltis (Cook) (Arachnida, Schizomida).

Abstract.—A mating pair of the schizomid *Trithreus pentapeltis* were captured and maintained for observation in a small terrarium. The female constructed a chamber in the soil next to the glass which afforded a view of the female's brooding behavior. Eggs appeared on her venter in 72 days and developed appendages 36 days later. 146 days after construction of the chamber the young molted and dropped off the female. 11 days later the female broke the chamber open and exited to the surface also enabling the young to escape. The complete life history for this order was heretofore undescribed.—J. Mark Rowland, Biology Department, Texas Tech University, Lubbock, Texas 79409.

Descriptors: Arachnida; Schizomida; brooding habits; chamber; development; chronology; molting.